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A novel way of measuring the endowment effect of gaining a child

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We test, using national survey data on Filipino women, whether stated fertility preferences are stable and, thus, reliable measures of choice. We compare the expressed ideal number of children of two groups of matched women with that of another group having arguably more stable preferences. Using propensity score matching, we find that the stated ideal number of children is significantly higher than the control group with presumed stable preferences, by about 1 child among the poor and among older women. This difference suggest instability in fertility preferences, which may be due to moving fertility targets, cognitive dissonance or anomalous choice behavior arising from status-quo bias, or endowment effects, with the prohibitive cost of "giving up" additional children causing an upward adjustment of fertility targets.

JEL classification: J13, I12, D13
Keywords: fertility preferences, endowment effects

1. Introduction

Demographic surveys typically ask respondents their "desired" or "ideal" number of children. Interpreting this variable could be a problem, however, particularly because the ideal number of children may be a moving rather than a fixed target [Lee 1980] or because the ideal number of children could be subject to status-quo bias [Thaler 1980] or endowment effects [Samuelson and Zeckhauser 1988].

Lee [1980] argues that, in explaining fertility, it is realistic to assume moving targets since couples cannot be expected to perfectly forecast their future socio-economic circumstances and must therefore frequently revise their fertility plans.

In experimental contexts, Kahneman et al. [1991] identify a status-quo bias: a preference for the current state because the cost of moving away from it exceeds the benefits. This is similar to an endowment effect, where current owners of a good value it more than those who do not have it. Applied to fertility choice, already having an additional child beyond what a couple originally planned could arguably cause a status-quo bias or endowment effect, since the disutility from "giving up" the additional child would easily outweigh the costs of raising it.

Responses to fertility surveys may also reflect societal norms and what respondents expect interviewers want to hear [Goldstein et al. 2003] rather than true fertility preferences. Similarly, mothers might report their ideal number of children to match their actual number as a way to avoid cognitive dissonance [Kuziemko 2009].

An important upshot is that policy makers should proceed with caution when using potentially biased survey information. The 2013 National Demographic Health Survey conducted in the Philippines, for example, shows that women in a union aged 15 to 49 years wanted 3.03 children on the average and actually had only 2.77 (Table 1). This apparently small and indeed even positive gap between the stated "ideal" and actual number of children would suggest that households are effective users of contraceptives. If so, then the current heated policy debates in the Philippines, which is predominantly Catholic, on whether the state should intensify efforts to provide family planning commodities especially to the poor are arguably unnecessary. On the other hand, this observation runs counter to national survey data which consistently show substantial unmet need for contraception [PSA and ICF International 2014].

TABLE 1. Average desired and actual number of children of women in a union and de jure resident of household, by income and age group (*N*=10,374)

Group	Desired number of children	Actual number of children	Gap (desired – actual)	(% of total)
By income				
Poorest	3.70	3.73	-0.03	19.3%
Poorer	3.05	3.09	-0.04	19.4%
Middle	2.85	2.69	0.16	20.5%
Richer	2.82	2.28	0.53	20.9%
Richest	2.76	2.11	0.64	19.9%
By age				
15-20	2.36	0.72	1.64	3.1%
21-25	2.58	1.30	1.28	11.9%
26-30	2.76	1.93	0.82	15.0%
31-35	2.92	2.51	0.42	18.9%
36-40	3.14	3.17	-0.02	17.6%
41-45	3.29	3.64	-0.35	17.1%
46-49	3.46	3.96	-0.50	16.3%
ALL	3.03	2.77	0.27	

Source: 2013 NDHS, authors' computations

Table 1 shows how desired and actual numbers of children vary systematically across income and age groups. Poorer women and relatively older women seem to want more children, a counterintuitive fact, since the poor are resource-constrained while older women face riskier childbirth.

We examine whether this behavior could be due to unstable fertility preferences. Choice "anomalies" are typically generated in experimental settings (see, for example, Kahneman et al. [1991]), particularly because non-randomized treatments may be prone to bias. This paper innovates by using non-experimental data from a large-scale survey to address potential biases through the use of propensity score matching (PSM). We are able to provide evidence of preference instability without, however, pretending to trace the causes.

2. Methods

We hypothesize that couples may have unstable fertility preferences. Fertility preferences are not always easy to achieve to begin with, given the physiological factors affecting fertility that cannot be controlled with precision (e.g., fecundity). When fertility targets are missed, new targets may be set. Moving targets are consistent with the notion that people can have a bias for the status quo, or that the effect of an endowment (i.e., an "extra" child) renders infinite the costs of disposal. Targets can also be reset to justify an unplanned outcome to avoid cognitive dissonance. We propose that the closest measure of ex-ante fertility preferences is the stated fertility target before childbearing starts, or less strictly, before one's fertility targets are attained.

To test the stability of fertility preferences, we first identify a reference group of women whose stated fertility preferences are presumed to be exogenous or independent of the actual number of children. We use the following reference groups: (i) those of childbearing age and in a union but still without children [R1]; (ii) those whose actual number of children is below the average desired fertility levels [R2]; and (iii) those whose actual number of children is below their own stated desired fertility levels as predicted by the data [R3]. R1 has yet to begin childbearing, while R2 and R3 have not yet attained their fertility targets. The distribution of sample women by reference groups is shown in Table 2.

TABLE 2. Distribution of women by reference groups

Group	R1	R2	R3	Total (*N* by reference group)
By income				
Poor	5.5%	58.6%	14.0%	4,507
Non-poor	8.7%	80.2%	15.6%	5,867
By age				
15-30	13.5%	93.4%	22.2%	3,571
31-49	4.5%	60.9%	11.3%	6,803
ALL	7.5%	71.8%	15.0%	10,374

Note: Figures are not mutually exclusive across reference groups.
Source: 2013 National Demographic Health Survey, authors' computations

For R1-R3, we generate a comparable sample through PSM, a method commonly used to estimate the average effect of a treatment that is not randomized. PSM begins with the identification of untreated matches for individuals receiving the treatment. Through a logit model, we generate propensity scores (or the probability of treatment) and individuals with similar scores are considered potential matches. Treatment effects are measured by comparing an outcome variable across treatment groups and their "untreated" counterparts whose respective propensity scores are matched using the caliper and radius matching method, and kernel matching tests [Caliendo and Kopeinig 2008].

In our analysis, belonging to a reference group (having no children or having less than the desired number of children and, arguably, having stable preferences) constitutes being in a control group. The treatment variable is the actual number of children, while the outcome variable is the stated desired number of children. Therefore, the women in the treatment group are those who have already achieved or exceeded their stated ideal number of children. We argue that any significant difference in the outcome variable between the treatment and control groups would indicate that fertility preferences are not stable.

Arguably, the women in the treatment and control groups may be systematically different from each other due to selection. To control for the possible selection bias, PSM requires that the treatment and control groups be matched based on a common set of observable covariates. We therefore match women on the basis of known determinants of fertility levels, namely, age, income, education, employment status, marital status, religion, years in union, and use of contraceptives (Bongaarts [1978]; Bailey [1989]; Hondroyiannis [2004]).

To ensure that matches are properly found for R1-R3, we examine the balancing properties of the matched sample by estimating the standardized bias before and after matching. The Mantel and Haenszel (mhbounds) test was also used to determine if a hidden bias arising from unmeasured variables might influence the matching process [Becker and Caliendo 2007]. After we assess the quality of the matches, we then estimate the average difference in the stated desired number of children and conclude that any significant difference would indicate instability of preferences. Using Stata 12 and *psmatch*2 [Leuven and Sianesi 2003], we estimated the average treatment using nearest 5-neighbor matching with caliper size 0.01, and their standard errors following Abadie and Imbens [2006].

Lastly, recognizing that fertility preferences are likely to change over one's life cycle, particularly as a woman ages and incomes increase, we perform tests on subsamples of women defined by age and income group. Effectively then the tests would reveal the heterogeneous impact of the treatment (actual number of children) between women of different age or income groups.

We use data from the 2013 National Demographic Health Survey, which covers 16,155 women of ages 15-49 from 14,804 households. The survey contains detailed information on fertility levels, marriage, fertility preferences, and use of family planning methods, among others [PSA and ICF International 2014]. The PSM analyses were limited to the subsample of women who are in a union (currently or formerly married or living-in with a partner) and this was further divided into four subgroups aged 15-30 (young), 31-49 (old), poor, and non-poor. The mean age of women in the selected subsample is 35, while the average number of years of education is 9.7.

3. Results

3.1. Overall quality of matching

Figure 1 shows the distributions of the treatment and matched control women for each reference group. As required, the matching are done along a common support (i.e., where the propensity scores of the treatment and matched control women overlap), thus giving each treatment woman, as it were, a chance of not receiving the treatment.

In Table 3, we also note the general improvements in the means and medians of the standardized bias achieved after matching, indicating the treatment and matched control units are now more alike. Only in the case of the matching for "R2: Age 30 and below" are the mean and median standardized biases remain above the conventional level (<5). Further attesting the quality of matching, the desired reduction in pseudo-R^2 and the failures of the LR χ 2 tests are achieved in most cases after matching.

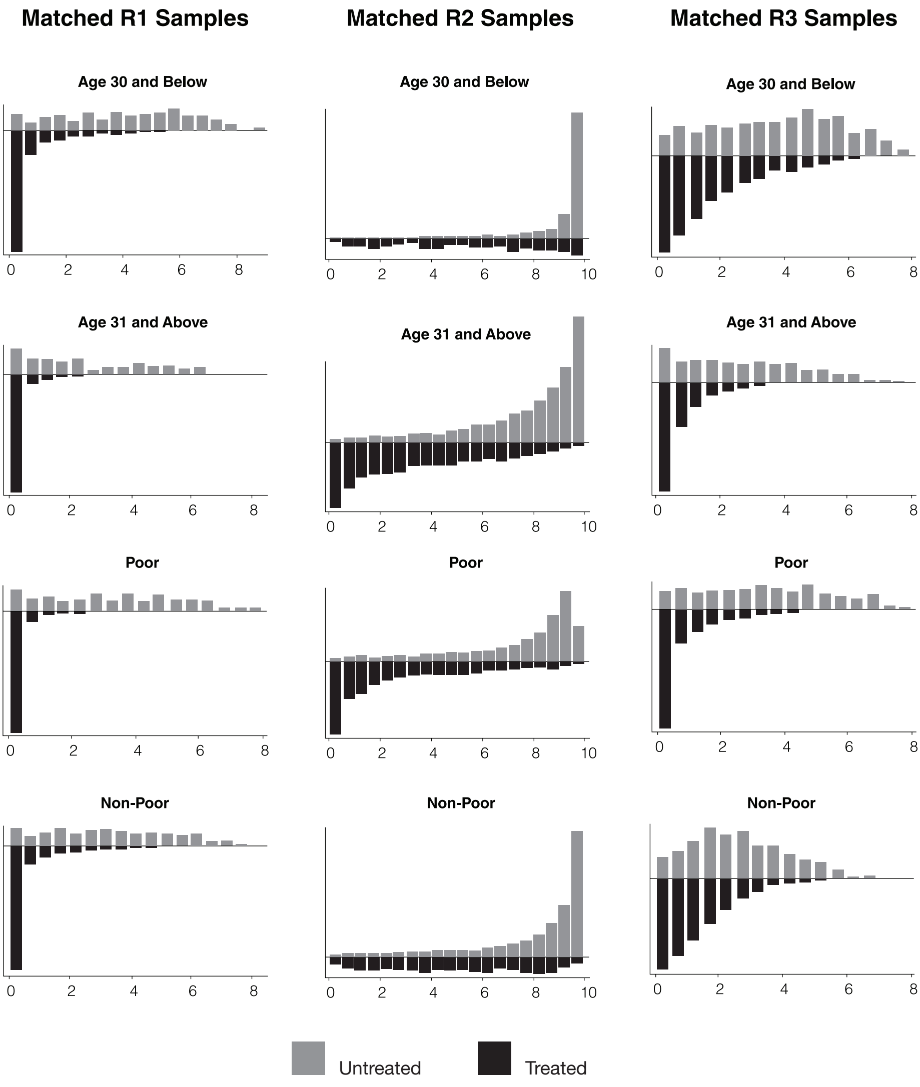

FIGURE 1. Histograms of treatment and matched control women, by propensity scores

TABLE 3. Pseudo-R^2 and LR χ^2, mean and median of standardized bias

	Pseudo-R^2	LR χ^2	$p > \chi^2$	Mean |Bias|	Median |Bias|
R1: Age 30 and below					
Unmatched	0.327	922.34	0	8.1	4.1
Matched	0.030	38.63	1	3.6	3.4
R1: Age 31 and above					
Unmatched	0.396	951.5	0	9.5	4.5
Matched	0.021	13.8	1	3	2.3
R1: Poor					
Unmatched	0.385	743.28	0	10.3	4.2
Matched	0.047	30.41	1	4.5	3.6
R1: Non-poor					
Unmatched	0.328	1153.58	0	7.6	2.6
Matched	0.023	32.63	1	3.1	2.3
R2: Age 30 and below					
Unmatched	0.459	840.76	0	13.2	5.7
Matched	0.258	1415.24	0	10.4	7.3
R2: Age 31 and above					
Unmatched	0.366	3368.24	0	8.2	3.7
Matched	0.075	785.12	0	4.5	3.1
R2: Poor					
Unmatched	0.457	2795.54	0	8.5	3.1
Matched	0.098	532.52	0	6	4.7
R2: Non-poor					
Unmatched	0.358	2102.73	0	8.2	3.6
Matched	0.109	1273.98	0	5.8	4.1
R3: Age 30 and below					
Unmatched	0.186	709.95	0	6.7	3.8
Matched	0.015	32.05	1	2.3	1.5
R3: Age 31 and above					
Unmatched	0.201	930.18	0	6.4	3.6
Matched	0.017	32.1	1	2.4	1.9
R3: Poor					
Unmatched	0.256	935.95	0	8	3.6
Matched	0.021	35.38	1	2.9	2.4
R3: Non-poor					
Unmatched	0.135	681.09	0	5.2	2.8
Matched	0.012	30.47	1	1.7	1.1

3.2. Average treatment effects on the treated

Figure 2 indicates that across all subsamples, the average treatment effects on the treated (ATT)—that is, the difference between the stated ideal number of children of the treated and control groups—is 0.26. The highest ATTs are observed among older women and poorer women, 0.30-0.55 and 0.16-0.41, respectively. On the other hand, the ATT for younger women is less than one child (0.19) and 0.20 for the non-poor women.

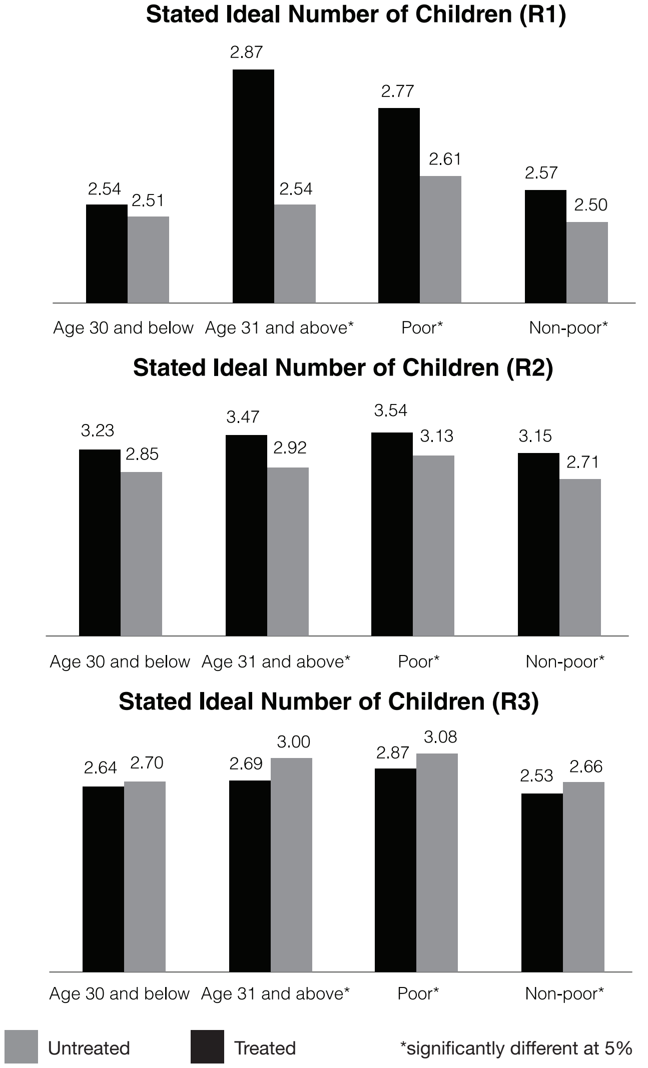

FIG. 2. Predicted stated ideal number of children from propensity score matching, treated and untreated

3.3. Sensitivity to hidden bias

Appendix 1 shows the results of the tests of the sensitivity of the estimated ATTs to possible hidden bias using the MH bounds tests statistics. Consistently in all tables we find that the null hypothesis that there is an unobserved characteristic that systematically overestimate the ATT since the test statistic Q_mh+ can be rejected at *p*<0.000. Likewise, there are is no strong evidence that an unobserved characteristic systematically underestimates the ATT since the test statistic Q_ mh- can be rejected at *p*<0.000. These results indicate that the list of observed characteristics we used in the estimation of the propensity scores are enough to account for the possible selection bias.

4. Conclusion

Our results show that stated fertility preferences are indeed unstable, especially among poorer and older women. Filipino women may be exceeding their true fertility targets by around 0.25 child on average, and up to 0.55 child for the elderly women and 0.41 child for the poorer women, or, by extrapolation, about 1 child. Fertility preferences could be subject to a status quo bias or an endowment effect, with the endowment (excess children) resulting from not having access to contraception. Perhaps the poor's fertility targets are more flexible upwards when they have children for insurance motives [Cain 1981]. They tend to justify the extra children when the children are seen as a way of smoothing household consumption in the future through intergenerational transfers.

These findings suggest that, contrary to what Table 1 seems to imply, government intervention may in fact be needed to help households gain control over their reproductive behavior, possibly through subsidized contraceptives for poorer women and medical advice to older women who may be unaware of their health risks. Future researchers also need to be mindful of potential biases when using data on stated desired fertility. These data tend to overstate true preferences, and statistical analyses using desired fertility could underestimate the potential effects of policy handles.

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Appendix 1. Tests of sensitivity to hidden bias: MH bounds

R1: Age 30 and below

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	35.422	35.422	0.000	0.000
1.1	34.542	36.358	0.000	0.000
1.2	33.750	37.227	0.000	0.000
1.3	33.040	38.049	0.000	0.000
1.4	32.399	38.831	0.000	0.000
1.5	31.816	39.578	0.000	0.000
1.6	31.281	40.294	0.000	0.000
1.7	30.788	40.982	0.000	0.000
1.8	30.331	41.645	0.000	0.000
1.9	29.906	42.286	0.000	0.000
2	29.510	42.906	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)

R1: Age 31 and above

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	30.147	30.147	0.000	0.000
1.1	29.298	31.067	0.000	0.000
1.2	28.538	31.927	0.000	0.000
1.3	27.865	32.750	0.000	0.000
1.4	27.261	33.540	0.000	0.000
1.5	26.715	34.302	0.000	0.000
1.6	26.219	35.037	0.000	0.000
1.7	25.764	35.751	0.000	0.000
1.8	25.345	36.443	0.000	0.000
1.9	24.957	37.116	0.000	0.000
2	24.596	37.773	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)

R1: Poor

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	27.337	27.337	0.000	0.000
1.1	26.618	28.121	0.000	0.000
1.2	25.969	28.846	0.000	0.000
1.3	25.390	29.536	0.000	0.000
1.4	24.869	30.197	0.000	0.000
1.5	24.397	30.831	0.000	0.000
1.6	23.966	31.442	0.000	0.000
1.7	23.570	32.032	0.000	0.000
1.8	23.204	32.603	0.000	0.000
1.9	22.865	33.157	0.000	0.000
2	22.548	33.696	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)

R1: Non-poor

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	39.742	39.742	0.000	0.000
1.1	38.702	40.846	0.000	0.000
1.2	37.774	41.878	0.000	0.000
1.3	36.945	42.860	0.000	0.000
1.4	36.199	43.798	0.000	0.000
1.5	35.522	44.698	0.000	0.000
1.6	34.903	45.563	0.000	0.000
1.7	34.334	46.398	0.000	0.000
1.8	33.808	47.206	0.000	0.000
1.9	33.320	47.989	0.000	0.000
2	32.865	48.749	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)

R2: Age 30 and below

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	46.907	46.907	0.000	0.000
1.1	45.144	48.787	0.000	0.000
1.2	43.605	50.581	0.000	0.000
1.3	42.252	52.308	0.000	0.000
1.4	41.051	53.977	0.000	0.000
1.5	39.976	55.592	0.000	0.000
1.6	39.006	57.160	0.000	0.000
1.7	38.126	58.684	0.000	0.000
1.8	37.321	60.167	0.000	0.000
1.9	36.583	61.614	0.000	0.000
2	35.902	63.025	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)

R2: Age 31 and above

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	76.076	76.076	0.000	0.000
1.1	74.143	78.088	0.000	0.000
1.2	72.426	79.977	0.000	0.000
1.3	70.890	81.769	0.000	0.000
1.4	69.503	83.475	0.000	0.000
1.5	68.241	85.106	0.000	0.000
1.6	67.085	86.671	0.000	0.000
1.7	66.021	88.176	0.000	0.000
1.8	65.035	89.629	0.000	0.000
1.9	64.119	91.034	0.000	0.000
2	63.264	92.395	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)

R2: Poor

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	56.434	56.434	0.000	0.000
1.1	55.048	57.879	0.000	0.000
1.2	53.810	59.228	0.000	0.000
1.3	52.699	60.503	0.000	0.000
1.4	51.694	61.713	0.000	0.000
1.5	50.778	62.866	0.000	0.000
1.6	49.937	63.969	0.000	0.000
1.7	49.162	65.028	0.000	0.000
1.8	48.443	66.046	0.000	0.000
1.9	47.773	67.028	0.000	0.000
2	47.148	67.977	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)

R2: Non-poor

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	72.524	72.524	0.000	0.000
1.1	70.243	74.934	0.000	0.000
1.2	68.246	77.232	0.000	0.000
1.3	66.484	79.440	0.000	0.000
1.4	64.913	81.570	0.000	0.000
1.5	63.499	83.628	0.000	0.000
1.6	62.217	85.624	0.000	0.000
1.7	61.048	87.563	0.000	0.000
1.8	59.975	89.450	0.000	0.000
1.9	58.986	91.289	0.000	0.000
2	58.069	93.085	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)

R3: Age 30 and below

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	47.451	47.451	0.000	0.000
1.1	46.245	48.720	0.000	0.000
1.2	45.168	49.907	0.000	0.000
1.3	44.205	51.032	0.000	0.000
1.4	43.336	52.105	0.000	0.000
1.5	42.545	53.131	0.000	0.000
1.6	41.821	54.115	0.000	0.000
1.7	41.155	55.063	0.000	0.000
1.8	40.538	55.978	0.000	0.000
1.9	39.965	56.863	0.000	0.000
2	39.430	57.720	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)

R3: Age 31 and above

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	49.569	49.569	0.000	0.000
1.1	48.200	51.015	0.000	0.000
1.2	46.987	52.380	0.000	0.000
1.3	45.910	53.683	0.000	0.000
1.4	44.942	54.932	0.000	0.000
1.5	44.067	56.134	0.000	0.000
1.6	43.269	57.295	0.000	0.000
1.7	42.536	58.417	0.000	0.000
1.8	41.861	59.506	0.000	0.000
1.9	41.236	60.564	0.000	0.000
2	40.653	61.594	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)

R3: Poor

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	43.536	43.536	0.000	0.000
1.1	42.396	44.742	0.000	0.000
1.2	41.380	45.872	0.000	0.000
1.3	40.473	46.947	0.000	0.000
1.4	39.656	47.973	0.000	0.000
1.5	38.915	48.958	0.000	0.000
1.6	38.237	49.905	0.000	0.000
1.7	37.614	50.819	0.000	0.000
1.8	37.039	51.703	0.000	0.000
1.9	36.504	52.559	0.000	0.000
2	36.005	53.391	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)

R3: Non-poor

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	55.490	55.490	0.000	0.000
1.1	53.971	57.089	0.000	0.000
1.2	52.627	58.599	0.000	0.000
1.3	51.432	60.039	0.000	0.000
1.4	50.358	61.419	0.000	0.000
1.5	49.385	62.746	0.000	0.000
1.6	48.498	64.025	0.000	0.000
1.7	47.684	65.263	0.000	0.000
1.8	46.933	66.463	0.000	0.000
1.9	46.237	67.629	0.000	0.000
2	45.589	68.763	0.000	0.000

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)